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10/575,352	01/31/2008	Richard E. Smalley	11321-P077WOUS	9439
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/575,352	<b>Applicant(s)</b> SMALLEY ET AL.	
	<b>Examiner</b> DANIEL C. MCCracken	<b>Art Unit</b> 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 20 September 2010.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-78 is/are pending in the application.
- 4a) Of the above claim(s) 39-73 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-38 and 74-78 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 April 2006 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

Citation to the Specification will be in the following format: (S. # : ¶/L) where # denotes the page number and ¶/L denotes the paragraph number or line number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

### ***Election/Restrictions***

Applicant's election without traverse of Group I (Claims 1-38 and 74-78) in the reply filed on 9/20/2010 is acknowledged. Claims 39-73 are acknowledged as withdrawn.

### ***Information Disclosure Statement***

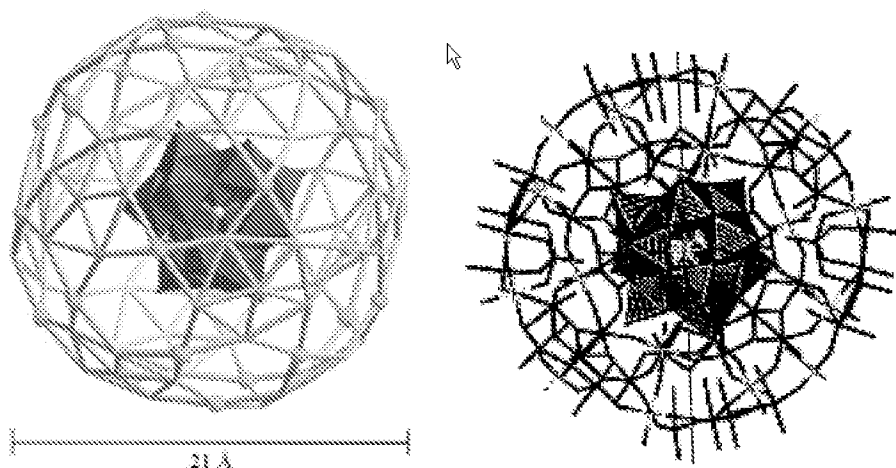
The information disclosure statement (IDS) submitted on 4/16/2007 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

***Drawings***

**I. Figure 6 is objected to.**

Figure 6 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Figure 6 appears to be copied from Figure 1 of Muller, et al., *A New Type of Supramolecular Compound: Molybdenum-Oxide-Based Composites Consisting of Magnetic Nanocapsules with Encapsulated Keggin-Ion Electron Reservoirs Cross-Linked to a Two-Dimensional Network*, *Angew. Chem.* 2000; 122(19):1555-1559. Figure 1 of Muller is reproduced below on the left next to Figure 6 of the instant application on the right.



Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

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To the extent any of the other figures are in fact from other publications, the Examiner requests this be made of record and the figures designated "Prior Art," accordingly.

***Claim Rejections - 35 USC § 101***

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

**I. Claims 8 and 26-27 are rejected under 35 U.S.C. 101.**

The claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under 35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd. v. Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966). Claim 8 recites the use of chemical derivitization to sort SWNT by type, but does not set forth any steps to do so. Claims 26-27 recites a use of SWNT for hydrogen storage, but does not set forth any steps to do so.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**I. Claims 8, 19-38 and 76-78 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

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Claim 8 provides for the use of “chemical derivitization,” but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced. As to Claim 19, the term “growth environment” lacks antecedent basis. Likewise, it is not understood what the “support” means in the context of the “growth environment.” As to Claim 20, the term “placing the single-wall carbon nanotube seeds in a growth environment” lacks antecedent basis. As to Claim 21, the term “growth environment” lacks antecedent basis. As to Claim 22, it is unclear whether anything is required by this claim, *i.e.* does the process make “multi-kilogram quantities” or is this merely aspirational? Furthermore, “precise populations” is indefinite. The discussion at (S. 7: [0032]) does not ascribe a special meaning or specifically define the term. Could this mean uniform diameters? Uniform chiralities? Both? Controlled numbers of nanotubes (*i.e.* a conventional definition of the term “population.”)? This term was not understood.

With respect to Claim 23, the “substantially all of the carbon nanotubes are of a sorted pre-selected chirality and diameter” language obscures what is required by the claim. The vague approximate language “*substantially all*” in connection with the mental step of “*pre-select[ing]*” the chirality and diameter makes it impossible to ascertain the scope of the claim. For example, what if quintuple-wall arm-chair and chiral nanotubes of 5.5 nm diameter were mentally pre-selected? Does the claim read on a process that includes any single walled zig-zag nanotubes? If so, how many of them can be included to address the “substantially all” limitation. This information was not found in the disclosure. Claims 26-27 provides for the use of single-walled carbon nanotubes, but, since the claim does not set forth any steps involved in the

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method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced. As to Claim 27, "optimum hydrogen storage" is a relative term not defined by the claim or specification. Optimum to who or what? Optimum for what purpose? Pre-selecting to these ends, as required by the claim, is not understood, not defined by the claim and not defined by the specification. As to Claim 28, the repetitive language "attaching" and "docking" is not understood. Does attaching something not dock it? Is limitation (b) really just describing a reducing step? The specification *might* suggest this. (S. 13: [0055]) If so, the Examiner suggests saying just that, *i.e.* "reducing the product of step a," etc. As drafted, the claim requires two docking steps and this is not understood in light of the disclosure. As to Claim 36, the term "support" is not understood when used to modify "growth environment." Does this refer to the catalyst or something else?

All dependent claims not specifically addressed import the ambiguities of the claims from which they depend.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**I. Claims 1-3, 6-10, 13, 17-18, 20, 22, 19, 21-25, 31, 34-38, 29, and 76-78 are rejected under 35 U.S.C. 102(b) as being anticipated by US 2002/0004028 to Margrave, et al.**

With respect to Claim 1, this claim requires “a) providing a plurality of carbon nanotubes.” Margrave teaches providing a plurality of nanotubes. *See e.g.* (Margrave 14: [0169]). Claim 1 further requires “b) cutting the carbon nanotubes to provide cut carbon nanotubes comprising lengths on the order of tens of nanometers.” Margrave teaches cutting. *Id.* (“A process in which one cuts segments of SWNTs.”). Claim 1 further requires “c) sorting the cut carbon nanotubes by type to provide sorted cut carbon nanotubes.” Margrave teaches sorting. *Id.* (“selects tube segments of a specific range”). Claim 1 further requires “d) docking at least some of the sorted cut carbon nanotubes to metal catalyst precursors to form carbon nanotube seeds.” Margrave teaches bonding (*i.e.* docking) metal (iron) to the tube. *Id.* Claim 1 further requires “e) growing the carbon nanotube seeds to form a carbon nanotube product of increased length.” The “seed” is grown to increase length. *See e.g.* (Margrave 15: [0181] *et seq.*) (“subjected to tube growth (extension) conditions.”). As to Claims 2-3, at least SWNT are disclosed. (Margrave 14: [0161]). As to Claim 6, derivatization is taught. *See e.g.* (Margrave 14: [0169]), (Margrave 1: [0010]) (“Derivitization of Single-wall Nanotubes”). As to Claim 7, insofar as this claim is generic to all nanotubes, derivitization is taught. *Id. See also* (Margrave 7: [0099]). As to Claim 8, notwithstanding the ambiguities noted above, sorting is taught. *Id.* As to Claim 9, functionalization is used to sort. (Margrave 12: [0138 *et seq.*]). As to Claim 10, clusters are taught. (Margrave 14: [0168]). As to Claim 13, catalyst are attached/docked. (Margrave 14: [0169]). As to Claim 17, reducing is taught. (Margrave 14: [0169]). As to Claim 18, hydrogen is taught. *Id.* As to Claim 20, growth in a gas stream (*i.e.* making a seed aerosol) is taught. *See e.g.* (Margrave 17: [0198 *et seq.*]). As to Claim 22, “tons per day,” *i.e.* “multi-kilogram” quantities is taught. (Margrave 16: [0193]). As to Claim 19, notwithstanding the ambiguities with this claim,



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supports are taught. *See e.g.* (Margrave 17: [0197]). As to Claim 21, hydrogen (Margrave 15: [0179]) and CO (Margrave 16: [0182]) is taught. As to Claim 22, see (Margrave 16: [0187]).

With respect to Claim 23, notwithstanding the ambiguities associated with this claim, this claim requires “a) providing a plurality of carbon nanotubes, wherein substantially all of the carbon nanotubes are of a sorted pre-selected chirality and diameter.” Margrave teaches providing nanotubes of specific diameter and chirality. (Margrave 14: [0163]). Claim 23 further requires “b) forming carbon nanotube seeds from the plurality of carbon nanotubes.” Seeds/catalysts are formed. (Margrave 14: [0162]). Claim 23 further requires “c) growing the carbon nanotube seeds in a growth environment to provide a carbon nanotube product comprising carbon nanotubes of increased length and of the pre-selected chirality and diameter.” The nanotubes are grown. (Margrave 14: [0163]). As to Claims 24-25, at least SWNT are taught. (Margrave 14: [0169]). As to Claim 28, notwithstanding the ambiguities above, docking and reducing are taught. (Margrave 14: [0169]). As to Claim 31, metal clusters are taught. *Id.* As to Claim 34, organometallics are taught. (Margrave “Claim 14”). As to Claim 35, hydrogen is taught. (Margrave 14: [0169]). As to Claim 37, gas phase/aerosol growth is taught. *See e.g.* (Margrave 17: [0198 *et seq.*]). As to Claim 29, cutting with the claimed dimensions is taught. *Id.* As to Claim 36, notwithstanding the ambiguities associated with this language, supports are taught. (Margrave 17: [0197]). As to Claim 38, hydrogen (Margrave 15: [0179]) and CO (Margrave 16: [0182]) is taught. As to Claim 76, the claimed phenomena is taught. (Margrave 15: [0179]). As to Claims 77-78, at least SWNT are taught. (Margrave 14: [0169]).

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***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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**I. Claims 1-3, 6-10, 13, 17-18, 20, 22, 19, 21-25, 31, 34-35, 29, 36, 38, and 76-78 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2002/0004028 to Margrave, et al.**

To the extent the 102 rejection (*i.e.* “Rejection I”) *supra* can be properly characterized as combining different embodiments from a listing of embodiments within the Margrave reference, a rejection under 35 U.S.C. 103 is made. The discussion accompanying “Rejection I” *supra* is expressly incorporated herein by reference, *mutatis mutandis*. The articulated rationale is that any combination of the techniques taught by Margrave would appear to be a combination of known techniques (“seed growth,” attachment, etc.) to achieve predictable results (carbon nanotubes). This does not impart patentability. *See* MPEP 2143.

**II. Claims 4 and 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 2002/0004028 to Margrave, et al. as applied to claim 1 above, and further in view of US 6,413,487 to Resasco, et al.**

The discussion of the Margrave rejection accompanying the 102 and 103 rejection is expressly incorporated herein by reference. As to Claim 4, to the extent Margrave may not disclose the recycle operation, these are known in nanotube synthesis and the Examiner takes official notice that they are. In support of taking official notice, *i.e.* in making sure there is “substantial evidence” on the record, the Examiner provides the Resasco reference. *See e.g.* (Resasco “Abstract”) (“The method also contemplates methods and apparatus which recycle and reuse the gases and catalytic particulate materials, thereby maximizing cost efficiency, reducing wastes, reducing the need for additional raw materials, and producing the carbon nanotubes, especially SWNTs, in greater quantities and for lower costs.”) One would be motivated to employ a recycle stream to “maximize cost efficiency,” as taught by Resasco. As to Claim 16, to

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the extent Margrave may not teach purification, this too is old and known and the Examiner takes official notice that it is. In support of official notice, Resasco is provided. *See* (Resasco “Fig 1”) (note at least step I). Purifying is an obvious expedient to arrive at a pure product for other applications, etc.

**III. Claims 5 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2002/0004028 to Margrave, et al. as applied to claim 1 and 29 above, and further in view of Gu, et al., *Cutting Single-Wall Carbon Nanotubes through Fluorination*, Nano Letters 2002; 2(9): 1009-1013 (hereinafter “Gu at \_\_\_”).**

The discussion of the Margrave rejection accompanying the 102 and 103 rejection is expressly incorporated herein by reference. As to Claim 5 and Claim 30, Margrave teaches cutting, but with sonication. (Margrave 14: [0169]). To the extent Margrave does not teach the cutting claimed, *e.g.* fluorination, this does not impart patentability. Fluorination as a cutting technique is old and known and the Examiner takes official notice that it is. In support of taking official notice, *i.e.* in making sure there is “substantial” evidence on the record, the Examiner provides Gu. *See* (Gu, entire document, title). Substitution of the two is an obvious expedient, as the techniques appear to be recognized equivalents and both publications are by the same authors, who happen to be the inventors.

**IV. Claims 11-12, 14-15, 32-34 and 74-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2002/0004028 to Margrave, et al. as applied to claim 3 and 28 above, and further in view of:**

**(i) An, et al., *Synthesis of Nearly Uniform Single-Walled Carbon Nanotubes Using Identical Metal-Containing Molecular Nanoclusters as Catalysts*, J. Am. Chem. Soc. 2002; 124(46): 13688-13689 (hereinafter “An at \_\_\_”).**

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The discussion of the Margrave rejection accompanying the 102 and 103 rejection is expressly incorporated herein by reference. As to Claim 11, to the extent Margrave may not teach the catalyst as claimed, note the combined teachings: Margrave teaches that a host of catalysts are suitable. (Margrave 15: [0175]). Margrave also teaches as an object of the invention to control diameter of the nanotubes. *See e.g.* (Margrave 14: [0163]). An teaches that nanotubes with controlled diameters can be grown from Fr-Mo nanoclusters. (An at 13689, col. 1-2). An appears to employ the compound designated by Applicants as “FeMoC.” (An at 13688, col. 1). One would be motivated to employ the nanocluster of An in the process of Margrave to control diameter of the nanotubes, as taught and suggested by both Margrave and An. As to Claim 12, use of a known solvent like ethanol is an obvious expedient to facilitate the reactions in solution, as taught by Margrave. (Margrave 8: [0100], [0130 *et seq.*]). As to Claim 14-15, the carboxylic chemistry appears suggested by the combination. *See also* (Margrave 14: [0171]). As to Claims 32-34, the discussion of Claims 11 and 14 is relied upon. FeMoC is an organometallic.

With respect to Claims 74-75, these claims combine other claimed embodiments addressed above. The discussion of the Margrave rejection accompanying the 102 and 103 rejection as well as the An rejection is relied upon, *mutatis mutandis*.

**V. Claims 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 2002/0004028 to Margrave, et al. as applied to claim 25 above, and further in view of Dillon, et al., *Hydrogen storage using carbon adsorbents: past, present and future*, Appl. Phys. A 2001; 72: 133-142 (hereinafter “Dillon at \_\_”).**

The discussion of the Margrave rejection accompanying the 102 and 103 rejection is expressly incorporated herein by reference. As to Claims 26-27, notwithstanding the ambiguities associated with this claim, to the extent Margrave *may* not teach hydrogen storage, this use of

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carbon nanotubes is old, known and well described in the literature. The Examiner takes official notice that it is. In support of taking official notice, *i.e.* in making sure there is “substantial evidence” on the record, the Examiner provides Dillon. *See* (Dillon, entire document). Use of a known material consistent with its known uses would be obvious to the skilled artisan in light of the explicit teachings identified above.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL C. MCCracken whose telephone number is (571)272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Daniel C. McCracken/  
Daniel C. McCracken  
Examiner, Art Unit 1736  
DCM